NASA/TM–2003–206892, Vol. 26

SeaWiFS Postlaunch Technical Report Series

Stanford B. Hooker, Editor
NASA Goddard Space Flight Center, Greenbelt, Maryland

Elaine R. Firestone, Senior Scientific Technical Editor
Science Applications International Corporation, Beltsville, Maryland

Volume 26, New Laboratory Methods for Characterizing the Immersion Factors of Irradiance Sensors

Giuseppe Zibordi, Davide D'Alimonte, and Dirk van der Linde
JRC/Institute for Environment Sustainability, Ispra, Italy

Stanford B. Hooker
NASA Goddard Space Flight Center, Greenbelt, Maryland

James W. Brown
RSMAS University of Miami, Miami, Florida

July 2003

Chapter 2

The Continuous Method for Determining Immersion Factors

Stanford B. Hooker
NASA/Goddard Space Flight Center
Greenbelt, Maryland

Giuseppe Zibordi
JRC/IES/Inland and Marine Waters Unit
Ispra, Italy

Abstract

The continuous method was implemented as a modification to the traditional method. In the latter, a series of incremental water depths are created by emptying (or filling) the water vessel in discrete intervals, whereas for the former, the tank is emptied (or filled) using a constant flow-rate pump. The tank emptying (or filling) is carried out in conjunction with the data logging, which leads to the creation of an optical profile, where the depth variable is the varying thickness of the water layer above the sensor. When compared to the traditional method, the continuous method provides a much faster execution of the ensemble of measurements required for $I_f(\lambda)$ determination. In the specific case of the traditional method implemented at CHORS, the execution time can be reduced from 120 min to 35 min.

2.1 INTRODUCTION

An alternative method for producing the data required for determining the immersion factor takes advantage of having a pump to drain the tank. In the case of CHORS, the pump was capable of an almost constant discharge rate. For a cylindrical tank, like the CHORS tank, this means the water depth can be approximated as a linear function of time when the tank is being emptied.

The principal advantage of the so-called *continuous method*, in terms of the actual execution of the method, is the time needed to complete an experimental trial is significantly reduced. As shown in Table 2, the typical time for a trial using the CHORS (traditional) method was 120 min, whereas it was about 35 min using the continuous method. In general, these trials included dark and background measurements, so the continuous method could be executed in about 30 min if only one of these measurements was made.

2.2 THE CHORS METHOD

The CHORS laboratory procedure for characterizing immersion factors for an irradiance sensor is an implementation of the traditional method (Petzold and Austin 1988). The apparatus used (Fig. 2) was designed to accept a large variety of sensor types, both large and small, from different manufacturers. Although measurement accuracy was an important objective of the method, another priority was to be able to execute the measurement process in a time-efficient manner.

The basic elements of the measurement protocol were the alignment of the mechanical and optical components, and the collection of in-air and in-water data for computing $I_f(\lambda)$. The alignment procedures were as follows:

- The tank lid with attached baffles, lamp holder, and rigid duct was leveled and aligned vertically.
- The lamp was powered on and the monitoring sensor was aligned by centering it in the projected light cone from the top of the rigid duct.
- The in-water sensor was iteratively aligned by centering it in the projected light cone from the light baffles and leveling it using a bullet level.
- The adjustable baffle was set to ensure the outer diameter of the projected light cone matched the outer diameter of the D-shaped collar fitted to the in-water sensor.

Although every effort was made to minimize any perturbation to the alignment when sensors were changed within the tank, some disturbance was inevitable. To ensure alignment integrity over time, occasional realignment checks were made over the course of the measurements.